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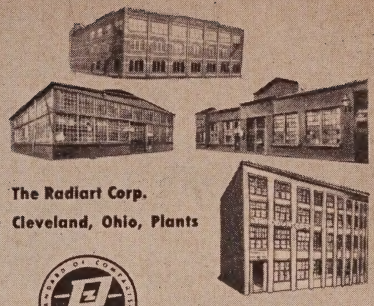

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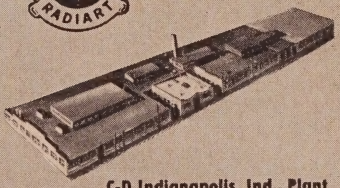

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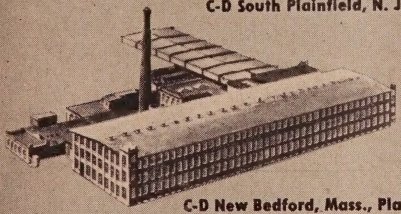

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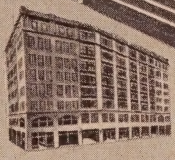

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# INDUCTANCE DATA FOR EXPERIMENTERS

Inductance is one of the three basic properties of conventional electronic circuits. Without it we would be hard put, at frequencies lower than microwaves, to tune our transmitters, receivers, and test instruments and to transfer electrical energy at one level to higher levels, all conveniently and effectively in the manner that we now do.

The experimenter and beginning technician soon acquire an appreciation of the functioning of radio coils. As they construct more equipment of their own, they quickly require as much practical information as possible regarding inductance. The existence of several types of "slide rules" and alignment charts for the quick determination of coil dimensions and inductance has not removed the need to know the basis upon which these devices are constructed. When the facts are understood, the technician is not inconvenienced when the "calculator" is lost, mislaid, or otherwise not available.

The purpose of this article is to present basic inductance data in its simplest form for the benefit of the student who is encountering these facts for the first time and for the other readers who may care to refresh their knowledge.

We believe that the coils selected for presentation are the particular types that the experimenter will be apt to construct. There are, of course, many more which are not practical to build in the small shop and which can be purchased more economically.

### Single-Layer Solenoids

The most universally-used radio coil is the single-layer air-core solenoid. In this type, a single layer of wire is wound on a cylindrical form. Often, in order to reduce losses at high frequencies, the form is eliminated entirely and the cylindrical coil made self-supporting **(air-wound).** But whether air-wound or form-supported, the coil still is classified as a solenoid.

The inductance of a single-layer solenoid may be determined by means of the formula:

$$(1) \quad L = \frac{0.2\ d^2\ N^2}{3d + 9\ell}$$

Where L is the inductance in microhenries,
d the diameter of the coil (inches),
$\ell$ the length of the coil (inches), and
N the number of turns

Figure 1 shows the dimensions of this type of coil. The length of the coil is the length of the actual winding, not of the entire supporting form. The diameter, likewise, is the diameter of the winding (measured from the radius of the wire). However, this will be the same as the form diameter (with negligible error) unless the wire is very thick.

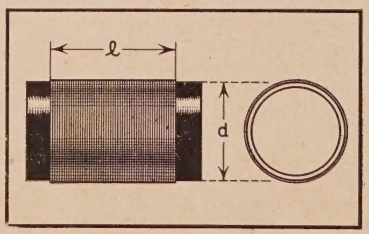


**Fig. 1. Dimensions of single-layer solenoid.**

**Illustrative Example:** A coil consists of 37 turns of No. 22 enamelled wire on a 2½-inch-diameter form. The length of the winding is found by measurement to be 1 inch. What is the inductance in microhenries?

$$L = \frac{0.2\ (2.5)^2\ 37^2}{3(2.5) + 9(1)} = \frac{0.2(6.25)1369}{7.5 + 9} = \frac{1711.25}{16.5} = 103.7 \text{ uh.}$$

From the formula and the example; note that for a given coil length and diameter, the inductance varies directly as the square of the number of turns. Also note that for a given number of turns and coil diameter, the inductance varies inversely as the length.

Formula (1) may be solved for the number of turns when the diameter and length of the coil have been chosen:

$$(2) \quad N = \sqrt{\frac{3d + 9\ell}{0.2d^2} L}$$

Where N is the required number of turns,
d the coil diameter (inches),
$\ell$ the coil length (inches), and
L the required inductance (microhenries)

**Illustrative Example:** How many turns will be required for a 50-microhenry coil having a diameter of 1 inch and a length of 1 inch?

$$N = \sqrt{\frac{3(1) + 9(1)}{0.2(1)^2} 50} = \sqrt{\frac{3 + 9(50)}{0.2}} = \sqrt{\frac{600}{0.2}} = \sqrt{3000} = 55 \text{ turns}$$

A coil is *closewound* when its turns are laid tightly side by side and are separated only by the insulation of the wire. It is *space-wound* when each turn is separated from the other by a discrete distance. In a given coil length, closewinding gives the maximum number of turns for a given size of wire. Closewinding also results in the highest **distributed capacitance** (capacitance due to capacitor effect between adjacent turns) because of the close spacing of turns. Since efficient r. f. coils must have low distributed capacitance, space-winding is preferred to closewinding.

A desirable configuration for a single-layer solenoid is obtained by making the coil length and diameter equal. This "block" shape should be effected whenever possible.

### Multilayer Solenoid

The single-layer, air-core solenoid becomes ungainly in size and often impossible to achieve with a good length/diameter ratio, when large inductance values (many turns) are required. More compact construction is secured by winding the turns in several layers, one layer upon the other. This is the arrangement of the layer-wound coil or multilayer solenoid (See Figure 2). Such coils often are wound on bobbins, spools, and similar supporting forms which can hold the various layers in place.

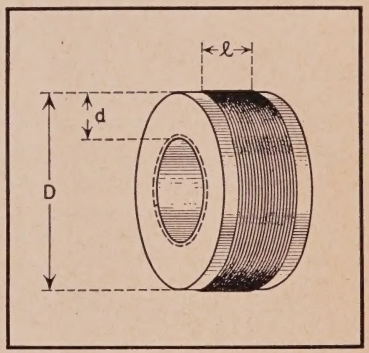


**Fig. 2. Dimensions of multilayer solenoid.**

The inductance of a multilayer solenoid may be determined by means of the formula:

$$(3) \quad L = \frac{0.2\ d^2\ N^2}{3d + 9\ell + 10D}$$

Where L is the inductance in microhenries,
d the diameter of the coil (inches),
$\ell$ the length of the coil (inches), and
D the radial depth of the coil (inches).

As in the case of the single-layer solenoid, the coil diameter is measured across the coil from the turn radii. However, when the form is wound full, this diameter will be the same as the diameter of the form itself as shown by the dimension D in Figure 2. Dimension d is the actual depth of the winding ("thickness" of the coil) and is measured from the radius of the outside turn to the radius of the inside turn (the latter is shown by the dotted ring around the hole of the form in Figure 2).

**Illustrative Example:** A 1½-inch-diameter bobbin is wound full with 150 turns of wire. The coil length is ½ inch. The bobbin wall around the ⅛-inch-diameter central hole is $\frac{1}{16}$" thick. The winding depth therefore is 0.625 inch (⅝"). What is the inductance?

$$L = \frac{0.2(1.5)^2\ 150^2}{3(1.5) + 9(0.5) + 10(0.625)} =$$

$$\frac{0.45(22{,}500)}{4.5 + 4.5 + 6.25} = \frac{10{,}125}{15.25} = 664 \text{ uh.}$$

When each layer of a multilayer solenoid is closewound, the result is a neat-appearing coil resembling a spool of thread. But the internal capacitance of such a winding is very high. In addition to the usual capacitance between adjacent turns in each layer, there also is capacitance between layers. This adds up to a troublesome total which reduces efficiency. The criss-cross winding methods (lattice-winding, universal winding, and duo-lateral honeycombing) were developed to reduce this capacitance by separating as nearly as possible all turns between which large capacitances ordinarily would exist. Special machines are needed to do this kind of winding, but substantial capacitance reduction can be achieved by the experimenter by deliberately avoiding neat winding. By allowing the turns to fall where they may, the familiar "jumble-wound" coil is produced.

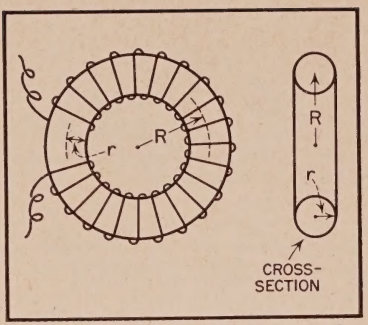


**Fig. 3. Dimensions of toroid of round cross section.**

## Toroidal Coils

The enclosed field of the toroidal (doughnut) coil recommends this type of winding for a number of exacting radio-frequency applications. While the **single-layer** torus is not as common as it was in the early days of radio, it appears probable that experimenters will in the near future become increasingly interested in the merits of this type of coil which can be made easily. A single-layer torus of circular cross section is illustrated in Figure 3. The dimensions of interest are the axial radius (R), the turns radius (r), and the number of turns (N). The inductance of this coil may be determined by means of the formula:

$$(4)\quad L = 0.00495\ N^2\left[R - \sqrt{R^2 - r^2}\right]$$

Where L is the inductance in microhenries,
N the number of turns,
R the axial radius (inches), and
r the turns radius (inches).

**Illustrative Example:** What is the inductance of a toroid coil of circular cross section having an axial radius of 2½ inches, a turns radius of ½ inch, and 230 turns?

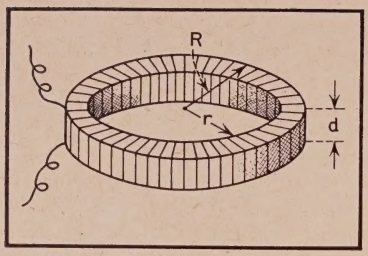


**Fig. 4. Dimensions of toroid of rectangular cross section.**

$$L = 0.00495(230)^2 \times \left[2.5 - \sqrt{2.5^2 - 0.5^2}\right] =$$

$$0.00495\ (52{,}900) \times \left[2.5 - \sqrt{6.25 - 0.25}\right] =$$

$$261.8(2.5 - \sqrt{6}) =$$
$$261.8(2.5 - 2.45) =$$
$$261.8(0.05) = 13.09 \text{ uh.}$$

Figure 4 shows a single-layer toroidal coil having rectangular cross section. An advantage of using a rectangular form for winding a toroid is the greater ease with which the turns may be pulled and held tightly in place during the process of hand winding. The important dimensions of this coil are the outer radius (R), inner radius (r), depth (d), and number of turns (N). The inductance of the rectangular toroid may be determined by means of the formula:

$$(5) \quad L = 0.00461\ N^2 d\ \log_{10} \frac{R}{r}$$

Where L is the inductance in microhenries,
N the number of turns,
R the outer radius (inches), and
r the inner radius (inches).

**Illustrative Example:** Calculate the inductance of a single-layer toroid of rectangular cross section having an outer radius of 3 inches, inner radius of 2¼ inches, depth of ¾ inch, and 500 turns.

$$L = 0.00461(500)^2 0.75\ \log_{10} \frac{3}{2.25} =$$
$$0.00461(250{,}000)0.75\ \log_{10} 1.335 =$$
$$1152.5(0.75)0.125841 =$$
$$1152.5(0.0944) = 108.8 \text{ uh.}$$

### Core and Shield Effects

The presence of dielectrics (cores or winding forms) in the field of radio-frequency coils introduces losses which are in-phase in nature and therefore appear as resistance. The effect of resistance is to lower the coil Q. For this reason, air-wound coils are superior to those wound on solid forms. Where the use of a form is unavoidable, a low-loss material, such as Polystyrene or ceramic is used.

Cores of magnetic metals (solid iron, high-permeability alloys, etc.) are not suitable for use in coils at high radio frequencies, although their increased permeability over air increases coil inductance tremendously at low frequencies. At radio frequencies, somewhat comparable inductance multiplication is afforded by cores of powdered iron, the particles of which are separately insulated. Modern **ferrites** (magnetic ceramics) are superior to powdered iron and provide material for cores which are efficient at very high frequencies.

Cores of non-magnetic metals (copper, brass, etc.) are subject to eddy current losses and by this mechanism reduce the inductance of any coils into which they are inserted. Because they are "losser" devices, these cores reduce the coil Q at the same time. Nevertheless, such cores in the form of movable slugs often are used for tuning coils in applications where the Q reduction can be tolerated.

Coils may be tuned with movable slugs either of magnetic or non-magnetic metal and are available commer-

cially in both types. The amount of inductance variation provided depends upon the nature and constitution of the slug material and upon its dimensions.

The purpose of shields is to confine the magnetic field to the immediate vicinity of the coil and thereby to prevent interference with and coupling into other portions of the circuit in which the coil operates, or into adjacent circuits. Since such shields are constructed of metal, their presence in the coil environment will tend to reduce the inductance and Q as a result of eddy current losses in the shield. For this reason, it is necessary to keep the walls of the shield as far as possible from the coil. This means that the best shields are large in comparison to the coils they house. A good practical rule is to make any shield of such size that its inside diameter is at least twice the outside diameter of the coil, and its height above the coil (and, if possible, below as well) is at least equal to the coil diameter. These are **minimum** dimensions. If the shielded coil stands too close to the shield walls, the coil efficiency will be reduced markedly. If the shield can be made larger than the minimum dimensions given, it will have less adverse effect upon the coil characteristics.

In order for a shield to be effective, its walls must be thick. Skimpy shields made of very thin sheet metal are hardly worth the time required to build them. A good shield also is closed on all sides. A shield full of holes and gaps is analogous to a sieve.

The foregoing discussion regarding reduction of inductance and Q by losses in metallic cores and shields applies also to any other such metallic object within the field of a coil. For example, operating a coil too close to a chassis, baffle plate, transformer, metal cabinet wall, or any other metal mass has a similar detrimental effect. Coils should be either mounted in the clear or well shielded for best results.

### Inductance Measurements

**Maxwell Bridge.** The Maxwell bridge is very handy for inductance measurement. Its chief merit is that it requires no standard inductor for comparison. Instead, the unknown inductance is checked against a standard capacitor. An accurately-known capacitor is more readily available to the experimenter than is a standard inductor. The Maxwell bridge may be assembled easily from laboratory or shop parts.

Figure 5 shows the Maxwell bridge circuit. L is the unknown coil, $R_1$ a ratio-arm resistor (several values such as 1, 10, 100, 1000, and 10,000 ohms must be available), $R_2$ a resistance-calibrated 10,000-ohm potentiometer, $R_3$ a resistance-calibrated 100,000-ohm potentiometer, and C a standard capacitor (several values, such as 0.001, 0.01, and 0.1 ufd. should be available).

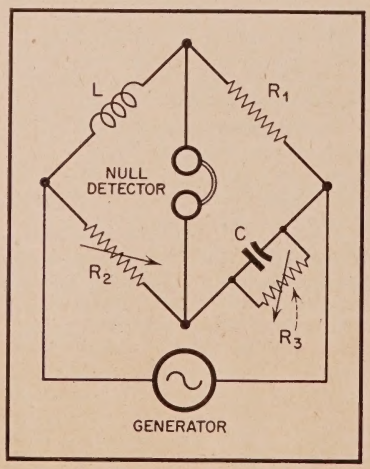


**Fig. 5. Circuit of Maxwell bridge.**

The generator preferably is a transformer-coupled 1000-cycle audio oscillator. The null detector may be headphones, a. c. vacuum-tube voltmeter, or oscilloscope.

The bridge is balanced for null by adjustment of potentiometer $R_2$. Potentiometer $R_3$ then is adjusted for improvement of the null. The operator works back and forth between the two potentiometers until exact null results. At complete null, the inductance (L) and equivalent series resistance (R) of the coil may be determined from the formulas:

(6) $L = R_1 R_2 C$

Where L is the inductance in henries,
$R_1$ and $R_2$ the potentiometer settings (ohms), and
C the standard capacitance (farads).

(7) $R = \frac{R_2}{R_3} R_1$ All in ohms

**Illustrative Example:** In a Maxwell bridge with a ratio resistor ($R_1$) of 1000 ohms and a standard capacitor (C) of 0.01 ufd. (0.00000001 farad), null is obtained at the 5000-ohm setting of potentiometer $R_2$ and at the 5000-ohm setting of potentiometer $R_3$. What are (1) the inductance of the test coil, and (2) the equivalent series resistance of the coil?

$L = 1000(5000)0.00000001 =$
0.05 henry (50 mh.)

$R = \frac{5000}{5000} 1000 =$
$1(1000) = 1000$ ohms.

**Hay Bridge.** The Hay bridge is particularly useful for checking high-inductance, low-Q coils. Like the Maxwell bridge, this circuit can be assembled from laboratory or shop parts. Figure 6 shows the circuit of the Hay bridge and gives the balance equations for inductance and equivalent series resistance. Note that, unlike the Maxwell bridge equations, a frequency term appears in the Hay bridge formulae.

**Resonance Methods.** Tuned-circuit methods are handy to the experimenter and service technician for measuring inductance at radio frequencies. The unknown coil is tuned to resonance with an accurately-known mica capacitor. The inductance then is

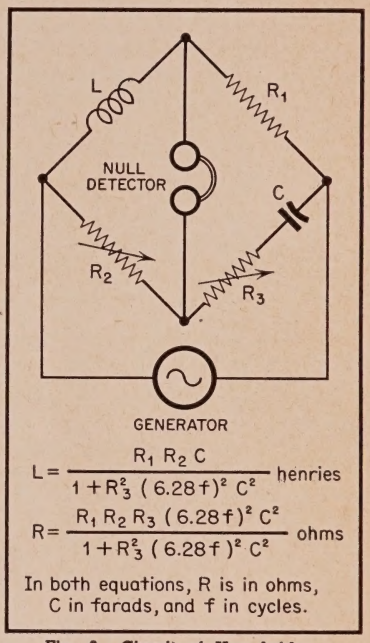
L
R1
NULL
DETECTOR
C
R2
R3
GENERATOR
L = R1 R2 C / 1 + R3^2 (6.28f)^2 C^2 henries
R = R1 R2 R3 (6.28f)^2 C^2 / 1 + R3^2 (6.28f)^2 C^2 ohms
In both equations, R is in ohms,
C in farads, and f in cycles.

**Fig. 6. Circuit of Hay bridge.**

calculated from the capacitance and frequency values. Two schemes are illustrated in Figure 7.

In Figure 7(A), the coil is connected in series with the known capacitor and coupled to a variable-frequency r. f. oscillator. An a. c. vacuum-tube voltmeter is connected **by short leads** across the capacitor. The oscillator is tuned through its range, starting at its lowest frequency and tuning upward, until the resonant point is located, as shown by peak deflection of the meter. At exact

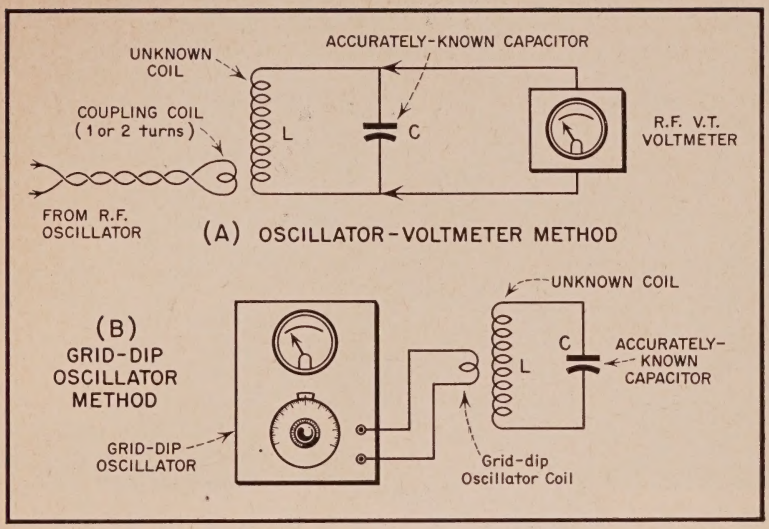


**Fig. 7. Resonance methods of checking inductance.**

resonance, the frequency is read from the oscillator, and the inductance calculated by means of the following formula:

$$(8) \quad L = \frac{25{,}400}{f^2 C}$$

Where L is the inductance in microhenries,
f the resonant frequency (megacycles), and
C the capacitance (uufds.)

**Illustrative Example:** An unknown coil resonates with a 100-micromicrofarad capacitor at 2.5 Mc. What is its inductance?

$$L = \frac{25{,}400}{2.5^2(100)} = \frac{25{,}400}{6.25(100)} = \frac{25{,}400}{625} =$$

40.6 uh.

Figure 7(B) shows how a grid-dip oscillator may be used for inductance measurement by the resonance method. The unknown coil (L) is connected in series with an accurately-known capacitor (C). The grid-dip oscillator is loosely coupled to the coil and tuned through its ranges, **starting at its lowest frequency and tuning upward.** At exact resonance, as indicated by a sharp dip of the meter, the frequency (f) is read from the oscillator dial. The unknown inductance then is calculated by means of Formula (8).

**Illustrative Example:** An unknown coil is connected to a 250-uufd. capacitor. A grid-dip oscillator is loosely coupled to the coil. Exact resonance is obtained when the oscillator is tuned to 1500 kc. (1.5 Mc.). What is the inductance of the coil under test?

$$L = \frac{25{,}400}{1.5^2(250)} = \frac{25{,}400}{2.25(250)} = \frac{25{,}400}{337.5} =$$

75.4 uh.

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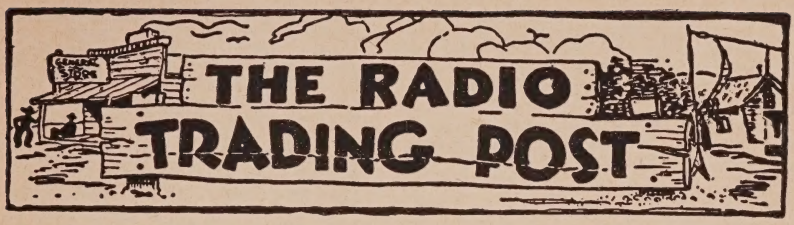


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**FOR SALE**—Simpson 5" Mirroscope model 476 perf. cond., used less than 2 months, $150. Will deliver in orig. carton in U. S. A. Lewis M. Clark, 105 Second St., Campbellsville, Ky.

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**FOR SALE**—Four vols. "Sams Photofact," $5 ea.; ATR auto radio B battery eliminator, $10; Sylvania Polymeter, $60. Ernest Bonem, 1110 Egan Ct., Cincinnati 29, Ohio.

**SELL OR SWAP**—Complete NRI comm. course including all equip. and textbooks, want test equip. or make offer. C. C. Roberts, 726-B, Lovelaceville Rd., Paducah, Ky.

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**FOR SALE**—Hickok Traceometer model 156 in almost new cond. with test cables and instruction book $125, FOB. Nell TV and Radio Service, 1452 Hayden Ave., Cleveland 10, Ohio.

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**SELL OR TRADE**—Nilson's master course in radio and electronics—4-years old. Want recvr. to cover aircraft band or make offer. Howard McCall, 1207-3rd St., S. E., Canton 7, Ohio.

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**FOR SALE**—RCP 447 VOM, like new $10. Trade antique Blickendorfer typewriter for good bug or xtal mike. G. Samkofsky, 527 Bedford Ave., Brooklyn 11, N. Y.

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**FOR SALE**—AEI model A-200 sig gen., like new, $35; 200 radio tubes, some used, $75; BN Capacitor Bridge, $15; RCP Mod. 411K Ohmmeter, $20; Kent-Moore tube tester, $20; Sprayberry course, $60. J. J. Rush, Rossville, Ill.

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**FOR SALE**—Hammarlund 420 transmitter $40; BC459A converted $15 with 30W pwr. supply $25; 630TCS $40 operating. Need EC-1 or EC-2. Henry Mohr, 1005 Wyoming St., Allentown, Pa.

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**SELL OR TRADE**—Two Cary safes—34" x 29" x 58" and 35" x 28" x 48" in good cond. Want tube tester or TV test equip. Robert Elbrecht, Box No. 138, New Milford, Pa.

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**SALE OR SWAP**—Model GI-R90L dual speed home recording assembly. Best offer or trade for Heathkit scope model 0-6 or later. C. B. Davis, 1468 Citadel Drive, N. E., Atlanta, Ga.

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**WANTED**—Riders TV manuals 6 to 9 and radio 21 and 22. Have radio tubes and parts. Write your requirements. E. K. Chenoweth & Son, 845 Union St., Warren, Ohio.

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**FOR SALE**—Like new, 2-BC 659H 10 meter mobile trans-recvr. with diagram and vibrator pwr. supply, 6V. or 12 V. $50 each. FOB P. Manganiello, 266 Hooper St., Brooklyn 11, N. Y.

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**WANTED**—Rider manuals 19 and 21. State lowest price. Elton Hoornstra, 305 Ann St., Sault Ste. Marie, Mich.

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**FOR SALE**—120W V. F. O 40 met. Xmtr. converted BC-459A with custom-built 525-250-250-12.6V. reg. cabinet pwr. supply; tuning unit; complete set spare tubes, shielded cables, parts, diagrams, like new and tested. $55. Roger Hoestenbach, 601 N. Lasseter, Odessa, Tex.

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**FOR SALE**—Sonar XE-10NBFM—eliminates BCI-TVI, like new, $13.95; Rider's manuals and books; Rola speakers. Want Viking at reasonable price—also 125w. mod. Xfmr. E. Tischler, 56 Carey Ave, Wilkes-Barre, Pa.

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**FOR SALE**—Riders 14, Television Simplified by Kiver (2nd edition): Elements of Radio by Hellman; aligning of Philco recvrs. by Rider (Vol II). Best offer plus postage. G. A. Galeota, box 62, Odenton, Md.

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**WANTED**—Parts for Meissner 150-B and Exciter unit; tank coils L207 and L208; also 3 ganged tuning condenser for Exciter or roton shaft with plates. Bob Caro, 20 Orchard St., Wellesley, Mass.

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**FOR SALE**—Radio Physics course; Radio Trouble Shooters Handbook; Modern Radio Servicing; all for $8. L. Matushefske, 2 Elmont Rd., Elmont, L. I., N. Y.

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**SALE OR SWAP**—Precision 844 VOM. Jackson tube tester, $10. Weston Master Universal light meter. Swap for 7-35 binoculars. W. W. Wehr, 35-B Glendale Manor, Pleasantville, N. J.

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**FOR SALE**—Pair of like new RCA 803's—$30; RCP model 309 tube checker, $35; pair lineman's climbing spurs and safety belt,excellendt cond., $10. Want Nat, SW Recvr. Dick Krukonis, box 123, Niverville, N. Y.

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**WANTED**—National precision condenser with micrometer dial model NPW3 3 Gang, 225 mmf per. sec. each—Rotor insulated from frame. State price and cond. Stephen O. Kucera, 2105 McElderry St., Baltimore 5, Md.

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**FOR SALE**—Emerson personal portable, $15; De Mornay Budd solenoid operated flash gun, $20; Moto-Scoot 2 hp, $50; Neptune 3/4 hp gasoline outboard engine, $40. C. Waterman, 703 Pleasant St., Athol, Mass.

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**FOR SALE**—Books: Engineering, Technical, Scientific; Electronics, Mathematics, etc. Will sacrifice. List on request. C. S. Morse, Turnerville, N. M.

**FOR SALE**—Hallicrafters S-36A, matching speaker, perf. cond., $125; BC 522 receiver conv., speaker & pwr. supply, $15; Converter covers 10,11 and 6 meters $20. Prices F. O. B. George Kirk, 317 College, Kent, Ohio.

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**FOR SALE**—Like new Weston electronic analyzer model 769—all probes included and instructions, $150. Ship express collect. P. P. L. 8749 Chrispin St., Holmesburg 36, Pa.

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**FOR SALE**—Complete 75 meter fone station, 225W. Bud DeLuxe table rack, SX 25 recvr. Want TV test equip. T. Trimmer, 53 S. Bedford Rd., Mt. Kisco, N. Y.

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**WANTED**—Two or four transmitter-recvr. units SCR-718 complete with or without tubes but without circuit changes, with covers, no cables needed. A-1 shape. A/1C Leon E. Walker, 1299 A. T. S., Bolling A. F. Base, Washington, D. C.

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**WANTED**—Plate Xformer Kenyon T-668 or similar type 1000-750-0. C. T. 300 ma. Have capacitors 2 mfd and 4 mfd 1500 VDC; Millen safety terminals; steatite terminal strips 37303-04; Exciter coils cathode 43640; plate 43043 for xtals between 3550 and 3562KC. A. F. Sylvia, Box 1133, Nantucket, Mass.

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**FOR SALE**—Riders radio manuals—2 to 17, $75, Riders TV 1-3, 5, 6 $45; Heathkit sweep gen., TS1—$25; Dumont scope 274—$60, 208B, $125, RCA 155A, $35. V. Iavarone, 1218 Leland Ave., Bronx 72, N. Y.

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**TRADE**—100W. AM Transmitter, fixed, coils for 10 meters and Millen Exciter. Want Kodak 35mm. camera; Sell, PE-103A dynamotor, $20. Frank J. Wojcik, 35 Hughes St., Maplewood, N. J.

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**FOR SALE**—WE 227D marine radiophone xmtr-rcvr. with crystals; W. E. 19A aircraft XMTR TBY-VHF XMTR-RCVR; Henney's Radio Engineering Handbook; "QST," Feb. '49-Dec. '52; A-1 cond. Best offer. R. H. Ives, Rt. 1-Box 109, Lynnhaven, Va.

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**SWAP**—Self contained disc recorder. Cuts up to 16" discs. 78 and 33⅓. Built in amplifier and broadcast recvr. Cost over $500. Trade for late model 4 x 5 Speed Graphic and accessories. V. Barker, 1326 West Stephenson St., Freeport, Ill.

**TRADE**—Jumbo Gibson guitar, like new, for BC 375 and 522 transmitters. James L. McCurry, R. D. 4, Lincolnton, N. C.

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**WANTED**—Mobile transmitter such as Elmac or Johnson; must be in clean, untampered cond. Need a VFO and tele-type equip. N. Wallen, Mansfield, Mo.

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**FOR SALE**—SCR-522 unmod. exc.; LM-7 unmod. exc.; Prof. HiFi 35w. amplifier, all refinements, 3-12AX7s 2-6L6s; misc. tubes; Babcock Preamplifier 14-30MC/S; RF-ammeter, thermocouple, Weston, 0-10 amps. Collins, Histella No 6, Santurce, Puerto Rico.

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**FOR SALE**—Supreme tube and set tester model 504-A $55; Simpson tube tester model 305, $45; Jackson VOM model 612 $18. 16mm sound movies exchanged free except postage. Wurms, Radio Service, 1015 W. Grant St., Appleton, Wis.

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**SELL**—21A midget printer, 12 page printer. WANT: ART-13, ATC, ARC-3, BC-610-E transmitters, BC-348, BC-312, BC-342, ARC-3, APR-4, APR-5, recvrs; DY-12, DY-17, TCS, Dynamotors. Selsyns, Loran, Radar, Test Equip. Tom Howard, 46 Mt. Vernon St., Boston 8, Mass.

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**WANTED**—4 x 5 Speed Graphic. Will trade Wilcox-Gay Mod. 250 Basic Tape & Disc Recorder with most of the parts for building amplifier. Bill Conterio, 4384 N. Eyston Ave., Chicago 41, Ill.

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**WANTED**—Low pwr. xmitter and recvr. for 220mc. Wish to contact hams interested in uhf in Hartford, Conn. vicinity. Tom Unnold, 87 Brown St., Hartford, Conn.

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**SWAP**—Electronic VTVM with sig. tracer built in, similar to volt ohmist. Also Supreme tube tester Mod No. 589A. Trade for 2¼ x 2¼ reflex camera. Mort Tubergen, 1912 Jerome Ave., Grand Rapids 7, Mich.

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**SWAP**—Like new Rider manuals vols. 6 to 13 for good Revere proj., 8mm., Hi-Fi amp, or what have you? S. W. Kovacs, 417 Vannest ave., Trenton 8, N. J.

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**FOR SALE**—R. M. E. 45 with speaker. Price $85. Anthony Girolami, 1245 Pinchot Place, New York 61, N. Y.

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**WANTED**—Lampkin 205 deviation meter. State age, cond., price. Edward Scribner, 311 Main St., Schoharie, N. Y.

**FOR SALE**—Conversatone Intercomm.-5 station master model MS5—6" x 6" x 12", 5 sub stations—push to talk sw. on each 4" x 6½" x 6¾" walnut cabinets—never used—$60. Ray's Radio & TV, Falls City, Neb.

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**WANTED**—Copy of Cathode Modulation Manual by Frank C. Jones, W6AJF. State cond. and price. Will pay reasonable cash price. B. W. Southwell, Box 861, Dixon, Calif.

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**FOR SALE**—2 like new 3" 0-1 M. A. meters in orig. boxes, square bakelite case with knife-edge pointer, ea. $4.50 Postpaid. L. Weinreb, 151-09-34th Ave., Flushing, N.Y.

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**WANTED**—Kits to wire. Tube checkers $7.50, Oscilloscopes $12.50, all others $6, or will trade work for radio parts and equip. No television kits. All work guaranteed. Prompt service. Arthur M. McGee, 415 S. Tower St., Nevada, Mo.

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**SALE**—Subraco MT-15X mobile transmitter; Subraco 400v. 175ma dynamotor; Gonset Converter and noise limiter; excellent HRO-50T recvr. complete; CREI course. Want cash or est equip., good cond. William F. Bibbings, 4114 Nazareth Rd., Kalamazoo, Mich.

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**SELL**—Radio receving set AN/CRW-2; 3-IN-23 Silicon Crystal Diodes; 2-RCA 829B (VT259) U. H. F. Transmitting tubes; 3-RK715-B tubes; 2-RKR-72, W. E. Co., 3-B-24; 2-RKR-73 tubes. Ship C. O. D. T. B. Winstead, Elm City, N. C.

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**TRADE**—Radio parts, tubes for photo enlarger and enlarging equip. Have Weston 3" meters, radio books, Admiral 7" TV (needs minor repairs). Harry Gursh, 1481 Shakespeare, New York 52, N. Y.

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**WANTED**—PE98E or F dynamotor; IE-36 test equip.; I-139A meter; M-299 mike adaptor; SCR522 instruction book; PL 169 to PL172 female connectors. State price & condition. J. Nichols, 709 E. 11th Ave., Ellensburg, Wash.

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**SELL OR SWAP**—RAL-4 .3-30mc. rec.; BC 1306 transceiver 80 mtr. mobile with PE237-6, 12v. supply. Best offer. Want ARB, TCS, APN-4, APN-9, TCP, RA10, Selsyns, Azimuth Ind. MN-22, MR9 etc., DU-1, control boxes, tech. manuals, loops. V. Rolfe, R. 1-Box 18, Lake Grove, Ore.

**FOR SALE**—Audio Engineering magazine from Feb. '48 through August 1952, excellent cond. J. P. Andrasko, 4404 Chestnut St., Philadelphia, Pa.

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**FOR SALE**—Simpson portable tube tester mod. 305, $15. Tests all tubes incl. TV 7 and 9 pin. Complete with operator's tube manual, good cond., R. C. Hequet, 795 N. 10th Ave., Kankakee, Ill.

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**SELL OR TRADE**—⅓ hp GE Capacitor motor; 1941 Buick auto radio; Beacon II camera with flash. Want .22 rifle. Outboard motor, test equip. or what have you? B. J. Urbany, 840 Cass Ave., Kingsford, Mich.

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**FOR SALE**—Battery eliminator, ATR model 610. Charge batteries. Output 6v. at 10 amps. Used twice. Cost $35, sell $20. Will ship COD in orig. carton. G. Brause, 351-27th St., San Francisco, Calif.

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**FOR SALE**—National NC-44 recvr., $50; Presto portable 2-speed 16" transcription Play Back type K-8, $95; Knight 50w AC amplifier $60; Army field phone set $15; 100w A. C. amplifier custom made $50; 4 large metal speaker horns $50. Brennan Utilities, Monroe, La.

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**SALE**—Precise RF, AF, TV Marker gen., $35; Bud-Code Practice Osc., $8; Heathkit VTVM model V-4A, $22; Power Supply, 375V at 200 MA, 6.3V at 5 Amps, $15; excellent cond. Leon Berandt, 8-7B Jacob Ford Village, Morristown, N. J.

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**FOR SALE**—Hallicrafter S20R—$35; Millen R9'r—$15; F. O. B. Frank W. Jones, Gabbs, Nev.

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**FOR SALE**—National NC-57 comm. recvr. 550 kc. to 30mc. In new cond., $70, shipped postage paid. Raymond L. Brown, Box 91, Meriden, Kan.

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**WANTED**—Antenna coil or complete tuner, if reasonable, for Learadio mod. 6617PC part No. 54284. Or information where available. Not available from factory. A. Edward Ruppel, 1207 Adams St., Saginaw 54, Mich.

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**FOR SALE**—Amplifier, p. p. 6L6 output, 4 input channels, Jensen JAP-60 spkr. unfinished bass-reflex cabinet, $100, local only. QST 1938-53 complete, $15 plus shipping. K and E slide rule, like new, $17. A. J. Lephakis, Box 69, Cambridge 39, Mass.

**SELL OR TRADE**—Three Norelco Duo-vues (One with 630 chassis, converted to remote control). Want cash, TV test equip. or? J. B. Frechen, 82-17 Woodhaven Blvd., Glendale 27, N. Y.

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**FOR SALE**—Hallicrafter Echophone recvr. Covers broadcast and amateur, 550 k. c. to 34 mc; Mimeograph machine; professional medical microscope; Riders manuals, etc. Fred Madlinger, Woodward Radio, 478 Woodward Ave., Brooklyn 37, N. Y.

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**FOR SALE**—NC-183 with spkr., NBFM adaptor, tilt base—perf., $205; Millen exciter with hvy. duty pwr. supply, coils, like new $75; Heath TC-1 tube tester, $25. Buyer pays postage. Need Sam's Photofacts. Stanley Wood, S. Berwick, Me.

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**WANTED**—A good quality tape recorder in perf. cond. Will pay cash or offer like new Heath & Eico test equip. in trade. Adrion Radio & TV, Hillsdale, N. J.

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**FOR SALE**—Excellent business location for Radio and TV Sales & Service with living quarters. Growing community, main highway, Suffolk City., L. I. Will consider experienced and responsible party with capital on partnership basis. Owner has other interest. G. D. Dalamango, 160-26 26 Ave., Flushing 58, N. Y.

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**FOR SALE**—Kenyon plate transformer T-668 1000, 750, 0, 750, 1000, 250 mils. $8; Kenyon Swinging Choke D-103 6-20 henries 300-30 mils. 5000v. insulation, $6; UTC driver transformer S-73 500 ohm primary to 807 or similar P. P. grids $4. Thomas Crane, 31 Haven Rd., South Portland, Me.

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**SELL OR TRADE**—Five, dual spkr. portable amplifier cases—black leatherette, size 18" x 14" x 9"; 1-5CP1, socket; 1-7BP7. Like new., $50 takes all. Want test equip. Heathkit—Eico. Johnson's Radio Shop, Box 255, Pineville, Ky.

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**FOR SALE**—NRI Comm. course manuals transmitter, tester — complete; HRTI-Radio TV service course, manuals only; Lafayette public address amplifier needs repair. E. R. Siedl, Box 302, Monticello, Ind.

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**WANTED**—Heathkit impedance bridge and Dumont 304A oscilloscope. State cond. and price. Alex Siegel, 1516 Shakespeare Ave., Bronx 52, N. Y.

**FOR SALE**—Hickok sig. gen., model 620 in first class cond. Postpaid and insured anywhere U. S. or Canada. $85. Gamble Store Dealer, Eaton Rapids, Mich.

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**TRADE**—1952 A-1 set of Compton's Encyclopedias (15 vols.) for complete Ham transmitter. James E. Mosteller Radio Shop, Andrews, N. C.

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**FOR SALE**—Gonset 10-11 converter and noise Clipper $20; Mc-Murdo Silver 701 transmitter and all coils $25; BC 474 recvr. and transmitter with tubes $75. SX42 recvr. and spkr. $150. Williams, 222 No. Main St., Waterbury, Conn.

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**FOR SALE**—To best offer—Hammurlund Super-Pro and pwr. supply. Don Barnes, 6 Wright's Lane, Glastonbury, Conn.

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**FOR SALE**—Hickok 288X $99; Hickok 288X manufactured less output meter $79. Both units clean and guaranteed A-1. Reasonable offers considered. Electronic Labs, 2444 "D" St., Lincoln 2, Neb.

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**WANTED**—Brush Mail-A-Voice Model BK 501. Does not have to be in perf. cond. Chas. T. Busby, 1225 Safford Ave., Fresno 5, Calif.

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**FOR SALE**—Eico 221 voltmeters, like new, $37.50, original guarantee. Bennie Flanagan, 1054-12th St., Des Moines 14, Iowa.

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**WANTED**—ART-13 Transmitter for personal use. Gonset tri-band converter or similar-type. State price in first letter, or what do you need? T. Williams, 100 Rugby Rd., Syracuse, N. Y.

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**WANTED**—Meissner sig. shifter EX model with pwr. supply in operating cond. Will pay $40. F. Kost, 431 Flamingo St., Philadelphia 28, Pa.

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**WANTED**—Top prices paid—Navy Selsyns 1DG, 1F, 1CT, 1G, 5DG, 5D, 5CT, 5G, 6G, 7G, etc., and BC-348, BC-221, AN/ART-13, AN/ARC-1 AN/ARC-3, AN/-APR-4, electronic surplus. B. Bernbaum, Lectronic Research Lab., 719 Arch St., Philadelphia, Pa.

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**FOR SALE**—Like new, LM-14 freq. meter, 125KC to 20MC, built-in modulation, 110v ac pwr. supply, complete with dust cover and calibration book $90. F. M. Breene, 5849 Faculty Ave., Bellflower, Calif.

**WANTED**—Instructograph or similar type tape code practice oscillator, with tapes. J. Sever, 13 Archbald St., Carbondale, Pa.

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**SALE**—LM7 frequency meter, orig. chart and crystal converted and a. c. operation; Lavoie freq. meter model 105SM, $70 each. Morris Tischler, 4600 Norfolk Ave., Baltimore 16, Md.

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**FOR SALE**—NRI comm. course complete. All kits unused, $75. Wilmatt, 1017 W. Monmouth St., Philadelphia 33, Pa.

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**WANTED**—12½," 14" or 16" used television set in good cond. Will pay cash. A. Schrier, 38 W. 182nd St., New York City.

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**FOR SALE**—Schematics on SCR-522-A: transmitter BC-625-A, recvr. BC-624-A and rack—$1; recvr. BC-624-AM and BC-624-C—$1 ea. Maintenance manual on Radio Compasses MN26-A-C-CA-M-W-X-Y $2.50. Ed Mack, 82 Broadway, Bayonne, N. J.

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**FOR SALE**—Hallicrafters recvr. Sky Challenger II (model SX-18) in perf. cond., equipped with crystal phasing and rejector. Best offer. M. DaCosta, 308½ W. 117th St., Los Angeles 61, Calif.

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**WANTED**—FB7 coils, must be reasonable; technical manual for Navy RAK-6 recvr. J. N. Moyer, 3235 Norwalk Drive, Dallas 9, Tex.

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**SALE OR SWAP**—National School's Radio course and seven or eight small radios in various states of repair. Want sig. tracer or 3-way portable in good cond. David Gordon, 55 Eastwood Lane, Valley Stream, N. Y.

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**SWAP**—Sam's vol. 1 with binder, Audel's New Electric Library, Radio-Electronics June '49 to date, Service Jan. 50 to Mar. 52. Want Rider's 1-5 abr. any others except 9 through 14. Eugene Hubert, Clarendon, Ark.

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**SALE OR TRADE**—Recvr. 150 KC-35 MC. ABC converter 3-6MC. Pair 12" Utah PA spkrs. with 4000 ohm fields. Crossman air pistol. Want HQ-129. Harvey Van Erem, Box 1085, Jamestown, N. D.

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**FOR SALE**—ES-500, E-400, E-200, EV-10P with High Volt. probe, 920P, Stancor 6v DC supply, A-1 cond., Sam's sets, tubes, resistors, capacitors, Riders 9-14, steel cabinet, etc. Will not ship. James Boschetti, 12 Adams St., Orange, Mass.

**FOR SALE**—Mounted RA-38 Rectifier, input supply 115v, 60 cycle, single phase. Maximum filtered output 15,000v. d. c. at 0.5 amp. Transtat regulator permits continuous variation of d. c. output voltage from zero to maximum. Like new, $350 f. o. b. Chromatic Television Lab. Inc., 703-37th Ave., Oakland 1, Calif.

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**FOR SALE**—Kilowatt phone transmitter—Variac controlled 5 pwr. supplies, 5 meters, built-in scope and antenna rotator. Pictures on request. SP400 super—pro recvr. rack mounted in transmitter. Want Viking II transmitter, Collins recvr. C. W. Cook, Rt. 2, Pollock, La.

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**WANT**—Will pay $35 each for Navy Selsyns 60 cycle, type 1G, 1DG, 1D, 1F, 1CT. Technical Materials Co., 50 Eastern Ave., Boston, Mass.

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**SELL OR SWAP**—Crosley—148CP 5-band ultrasensitive, AM-FM phono., excellent tone, exquisite cabinet; sun lamp, hardly used. A. Newton, 105-20 66th Ave., Forest Hills 75, N. Y.

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**FOR SALE**—Hallicrafter HT 17 transmitter, 25w, tubes, meter, 40 meter coil (no crystal), perf., $40. Instructograph, electric, 12 tapes including 2 ham tapes, $25. W. B. Sillivan, 1501 Pine Knoll Lane, Mamaroneck, N. Y.

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**SELL**—National SW54 comm. recvr., never used; paint sprayer; gun, hose, used very little, $40. or trade for cash or test equip. of like value. G. S. Garrigan, 357 Plymouth Rd., Union, N. J.

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**FOR SALE**—C. D. Capacitors from April, 1940, Rider's Successful Servicing, July, 1946, to date. No reasonable offers refused. Frank J. Connor, 3449 Thomas Ave., Minneapolis 12, Minn.

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**SELL OR TRADE**—Eico Mod. 214-K TVVM, like new, $35. Need Hallicrafters S-20R, National type BM-1, 2, 3 vernier dials. Chester Wegrzynowski, 51 N. Central St., Buffalo 12, N. Y.

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**WANTED**—Hallicrafter TV chassis model 1000, or complete with cabinet. Pilot-tuner FM—$20. Ben's Radio, No. Tonawanda, N. Y.

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**SELL OR TRADE**—Amertran plate transformer 2440-0-2440v secondary; 60 cps. 110v. primary. Catalog listing—EP 2402, list price $60. Used very little. Make offer. Weston H. Beale, 221-C Haddon Hills, Haddonfield, N. J.

**WANTED**—Technical manual for McMurdo Silver sig. gen. model 906 also G. I. technical manual for Hallicrafters SX28. William Alnick, 128 Devon Terr., Kearny, N. J.

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**SELL OR SWAP**—National Schools Radio and TV Course, for Heath tube tester, unassembled, or assembled. Agostino, 223 So. Winebiddle Ave., Pittsburgh 24, Pa.

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**FOR SALE**—NRI comm. course with kits (9) and 78 lesson texts, in good cond., $78. T. J. Englert, Jr., 1601 France St., New Orleans 17, La.

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**FOR SALE**—Intercommunication Master, Bell Sound Systems "Belfone" Model 460-S, piano type pushbutton station selector keys, Durez plastic cabinet, excellent cond., $25. F. O. B. L. Buddine, 4624 Old York Rd., Philadelphia 40, Pa.

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**WANTED**—Western Electric Telephone Equip. and parts for common battery system with instruction books, and diagrams. Have some equip. and parts to trade. James W. Hoskins, 1439 Ohio St., Vallejo, Calif.

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**SWAP**—Sandard brand, late types, radio-TV tubes for test equip., 3-speed record player, surplus equip., or what have you? S. Consalvo, 2507 Southern Ave. SE, Washington 20, D. C.

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**WANTED**—Aircraft radios; VHF transmitter and LF receiver. Suitable for installation in light planes. Frank Sikonski, 19 Oakwood Ave., Saylesville, R. I.

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**SELL OR TRADE**—3 PE 103 dynamotors less bases. Want radio equip. for light planes. Center TV Co., 867 Broad St., Central Falls, R. I.

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**FOR SALE OR TRADE**—All kinds of surplus radio parts including two BC 454's and a BC 645. Prefer—local deals. No dealers. M. Youngman, 515 South Blvd., Oak Park, Ill.

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**FOR SALE**—Knight model 512 10 tube AM-FM tuner; Knight—15w. amplifier; Shur model 708 A mike; G. E. S-1 201 spkr with baffle; Heath V2—VTVM; G-1 sig. gen. No reasonable offer refused. W. A. Larsen, 309 George St., Hanover, Pa.

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**WANTED**—6, 12, 24, 32v motors, fans, or what have you? Bismarck Electric Co., 26 Front St., New York City

**FOR SALE**—Dukane tape recorder, $145; Anchor 2-stage booster, $18; Webster 3-speed changer, $16.50; RCA 45 phono. player, $25. H. Gold, 209 S. 3rd St., Brooklyn 11, N. Y.

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**FOR SALE**—Precision E-200 sig. gen. $25; Sparx 905A sig. tracer, $25. Both in good cond. T. F. Smith, 223 Valley View Homes, Elyria, Ohio.

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**SWAP**—BC457-A transmitter, new cond. want PE 103 dynamotor in good cond. Crandall's Radio Service, 634 E. Huron, Bad Axe., Mich.

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**SELL OR TRADE**—ATR Inverter 110 d. c. to 110 a. c. 200w. Used one week, reed broken in vibrator. Perf. otherwise. Want Heathkit Scope or VTVM. Roy G. Humphreys, Ballard, W. Va.

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**FOR SALE**—New Mark II transmitter and receiver, 80 and 40 meters and high freq. tranceiver, all in one unit—Phone or CW complete with key, headphones, and mike less pwr. supply. $35 F. O. B. B. G. Whitehill, 54 Poplar Ave., Niles, Ohio.

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**TRADE**—Chicago-Webster wire recorder almost new, for anything in radio or TV line. Eugene De Cobert, Jr., 609 Henrietta St., Gillespie, Ill.

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**WANTED**—Driver transformer, 500 ohm line to pushpull grids class B, original "Thordarson multimatch Cat. No. T15D-82 or T15D83. Elmer J. Bergstraser, 11 Cottage Pl., Baldwin, N. Y.

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**FOR SALE**—Sola voltage regulator, 500 VA, like new, $40; also BC-433G, $15. J. H. Schultz, 1225 Franklin, Springfield, Ill.

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**FOR SALE**—Vibroplex key or 'bug' with carrying case—$12, or swap for multimatch modulation transformer, 75 to 100w. M. Goodman, 2621 Burns Pl., Union, N. J.

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**FOR SALE**—Ship to shore radio—Jefferson Travis model 101—two extra sets crystals and vibrator, $70, F. O. B. J. Hallock, 1414 Caffrey Ave., Far Rockaway, N. Y.

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**WANTED**—Commercially built "Q" Meter. State make model, cond., and price. Marvin Radio & TV, 14 E. 208 St., Bronx 67, N. Y.

**FOR SALE**—Onan 5000w. 115/230v. a. c. emergency gen. with line transfer switch like new, $466. John W. Reigel, R. D. 2, Annville, Pa.

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**FOR SALE**—Webcor, model 210 tape recorder, like new, $145; Heathkit, 5" oscilloscope, assembled, good working cond., $25. Eugene Kon, 1575 Broadway, Buffalo 12, N. Y.

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**WANTED**—Hickok or RCA used sig. gen., sweep gen., marker gen., TV alignment gen., and oscilloscope. State price and cond. M. Vincoff, 4849 N. Hutchinson St., Phila 41, Pa.

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**WANTED**—To buy or borrow, tube setup chart for "Daco" model 303 tube tester. Henry Kurutz, 562 Pittston Ave., Dupont, Pa.

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**FOR SALE**—Ten RCA 6J4 tubes at $4.50 each. Postpaid insured parcel post. Harley L. Christ, Metamora, Ill.

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**WANTED**—Rek-O-Kut 16" turntable 33 and 78 rpm., with Hysteresis sync motor model G-2 or B-16H, DuMont Cathode Ray Tube 5LP1-A in good cond. L. J. Schnedorf 610 Monroe Ave., River Forest, Ill.

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**SWAP**—Like new Astatic AT-1 booster for desk type crystal mike (GT-3 or like value) or constant voltage transformer, as Regent TV line booster. A. L. Guide, 17 Wolcott St., Malden 48, Mass.

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**FOR SALE**—1951 Ford DeLuxe radio comp. with all installation hardware and spkr. Excellent cond., $45 f. o. b. Harvey Van Erem, Box 1085, Jamestown, N. D.

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**TRADE OR SELL**—Gonset 10-11 converter, $20; Eicor 6v. dynamotor, 420v. 280 mil, $12. Need 20 meter beam. Farmer, Cook Drive, Baldwinsville, N. Y.

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**FOR SALE**—National HRO 7 with spkr. and 4 coils A, B, C, D. $150. Thomas Putalik, 3141 Sedgwick Ave., Bronx 63, N. Y.

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**SELL OR TRADE**—IRE Proceedings, March 1951—Jan 1953; triumph mod. 830 scope; 10 meter Gonset. Want guns. P. W. Oliver, Sunflower, Kan.

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**FOR SALE**—Like new Sparx 905A sig. tracer, $30; Riders 1 to 9 perf. plus 5 Sam's folders all $45. Dick Miller, 1934 E. Broadway, Muskegon, Mich.

**SWAP**—Like new, Silver sig. tracer for Riders Radio Manuals or Tel-Ohmike. Prefer local. Ralph Watts, 125 Second Ave., Bay Shore, L. I., N. Y.

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**SELL OR SWAP**—Prof. NRI sig. tracer model 33, excellent cond. Want deer rifle—comm rec.—NC54 or S38. Cash or what have you? Geo. G. Lau, 147 N. 3rd Rear, Hamburg, Pa.

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**WANTED**—TV test equip. Have 7," 10," 12," 16" TV sets. Troch's, 290 Main St., Spotswood, N. J.

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**FOR SALE**—Norelco Duo-View TV proj. set, 630 chassis, standard coil tuner, mahogany cabinet. Cond. new. Complete with radiant beaded screen, $250 FOB. J. Eastwood 115 Center Drive, Franklin Square, L. I., N. Y.

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**FOR SALE**—Kilowatt phone and CW transmitter, rack and panel assembly, spares, bring a truck. $250 complete. William H. Dore, 276 Gilmore St., Williston Park, N. Y.

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**FOR SALE**—6—164 transmission tubes; 1941 Ford radio; 1942 Chevrolet radio. Early Latt, P. O. Box 142, Fayette, Miss.

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**SELL OR SWAP**—3½ hp Firestone outboard, NRI VTVM, AC-DC radios, Thyratron remote control. Want Eico test equip. Sam Nester, Van Meter, Pa.

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**FOR SALE**—Heathkit condenser checker C2 completely assembled, used very little, in perf. cond., $19.50 F. O. B. De Na Radio Service, Dodgeville, Wis.

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**FOR SALE**—Like new, Meissner analyst complete with tubes, test probes and instruction book, $55. Berman Distributing Co., 1188 Broadway, Brooklyn 21, N. Y.

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**WANTED**—Four-channel microphone mixer, broadcast quality like RCA, Raytheon, etc. Alan Kaufman, 12-23 Orchard St., Fair Lawn, N. J.

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**FOR SALE**—Heathkit: VTVM, $25, signal tracer, $20, sig. gen., $20. Manuel J. Smith, 1205 Lamanche St., New Orleans 17, La.

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**SWAP**—Riders 17, P. A. manuals, 7" CR tubes, radios. Want Millen Test meters, Heathkit 06, 05, scope late tubetester, Triplett PB VOM, SX42 or similar, VTVM. M. Orange 11, Brooklyn Ave., Westbury, N. Y.

**FOR SALE**—10" round picture tube with deflection, focus coils and mounting, 16" rect., Picture tube; all in good cond. No reasonable offer refused. Local transaction only. Geo. H. Johnston, 6380 W. Columbia Ave., Phila. 31, Pa.

**TRADE**—Parts catalogs and adjustment manual for mod. 12 teletype. What do you have? R. A. Neff, 4220 W. 223rd St., Fairview Park 26, Ohio.

**FOR SALE**—Tube tester, Philco, mod. 7050, like new—best offer over $25. f. o. b. Williamson Radio Service, 631 W. Dallas Ave., Cooper, Tex.

**FOR SALE**—Recently completed NRI Radio and TV course, no kits. All inquiries answered. C. Gabler, 1307 Merriam Ave., New York 52, N. Y.

**WANTED**—35mm polarized stereo proj., Stereo-Realist, TDC, etc. Screen & polarized glasses. Cash or trade ham equip.; RCA-807—Class B 10M mobile xmtrs; BC610 exciter & modulator decks, PE103, etc. Robert Franks, 29 Gould Ave., Bedford, Ohio.

**FOR SALE**—Used A. C. radio chassis of standard famous makes. Louis A. Goldstone, 1279 Sheridan Ave., Bronx, N. Y.

**FOR SALE**—Solar C E Exameter $30; Philco 050 tube checker, nine-pin socket installed $20; Bliley CCO 1 sig. gen. $25. All in good cond. Cash or trade for photographic equip., or 2 speed tape recorder. Meyer Londer, 1220 Magee St., Phila. 11, Pa.

**FOR SALE**—Westinghouse Elapsed Time Meter 0-99 999.9 hrs., 110v., 60 cy. Self starting. $12.95 ea. H. J. Lewis, 548 Brompton, Chicago 13, Ill.

**WANT**—Sig. gen., Clough-Brengle, type-82, in A-1 cond. Will swap tubes, etc. What do you have? Paul Blum, 366 Hunterdon St., Newark, N. J.

**FOR SALE**—HQ 129X Communications rcvr., with spkr, complete. Excellent cond., $125 F. O. B. Richard A. Freedman, 105 E. 13th St., New York 3, N. Y.

**SELL OR SWAP**—Turner dynamic microphone, McMurdo 904 Resistance Bridge, Jackson M-420 AM FM OSC, Triplett model 763. Need Bud deluxe rcvr. cabinet, GE ST-2A, metal case BC-221H, Hewlett-Packard VTVM, 200B audio osc. Scott Radio Appl's, Benld, Ill.

**SELL OR SWAP**—Eico model 425K 5" scope for $45. Can use tube tester. Albert Speaker, 10334 Faywood St., Bellflower, Calif.

**WANT**—Late model oscilloscope, Hickok 209 VTVM, Rider's 18 thru 21, mobile Mastermount Antenna. Sell Rider's 6 thru 14 at $10 ea., '41 Buick Radio excl. $17.50; many other items servicing or amateur. A. Park, 1043 Alta Ave., Mt. View, Calif.

**SELL OR TRADE**—Misc. servicing capacitors and resistors; 12" TV chassis with tubes; Motorola car radio, 8 tube Superhet. with 1000 hour battery, like new. I. Zambakion, 79 Sunset Ave., Glen Ridge, N. J.

**WANTED**—Test equip.; Riders manuals 1 to 23 except 6.10 15.16 22; 1 also 2 to 10 on TV; tubes, resistors, condensers, Truetone model 692 transformer. Frank Kesto, R.1., North Rose, N. Y.

**WANTED**— 2 Handie Talkies or 2 portable transceivers. N. H. Anderson, 216 B. Garden Homes, Savannah, Ga.

**SELL OR TRADE**—Webster wire recorder motor mechanism M15 2 drums Shure No 812 wire recording head 7EP4 C. R. T. J. Cooper, 1096 W. Farms Rd., Bronx 59, N. Y.

**WANTED**—Meissner Instruction Manual; VTVM and wire recorder. Will trade for other test Instr. Francis Muto, c-o A. B. C. Radio, 459 W. Belden, Chicago, Ill.

**WANTED**—2 mtr. gear, and rotator, etc. Loads of gear here to swap or sell. Charles Fernandez, 81 Warren St., Roxbury 19, Mass.

**FOR SALE**—Final stage 813—5 band; 160 meters — all band switching—VFO—Meissner ex model. Pr 5514 modulators; Speech Amplifier 6SQ7-6C5-6C5-pr 6A5G-5T4, this is separate chassis with its own pwr. supply. Louis D. Cinci, 204 Charter St., Clarksburg, W. Va.

**SELL**—Bogen C-10—Amplifier. Portable case. 10" Cinaudigraph spkr.-tubes. 15w. plus.—7N7, 7N7—6V6's 5V4G. Excellent quality. 50 ft. spkr. cable, $45. RCA No. 41903 electronic control complete, good cond., $25. R. N. Eubank, 1227 Windsor Ave., Richmond 27, Va.

**FOR SALE**—Simpson tube tester, model 305. Tests late tubes. Good cond. $20. Melvin Saur, Kent City, Mich.

**SWAP OR SELL**—P. E.-103 complete with cables, perf.; Electronic Lab's Vibropack and ac pwr. supply,new cond. Want good photo enlarger with lens—Wallace Printz, 1177 E. 14th St., Brooklyn 30, N. Y.

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**WANTED**—Transvision CRT tester, reactivator., good cond., and reasonable. also H. V. probe for Vomax 900-A-VTVM. Sell 868 A-1 tube, $1.00. L. E. Polikoff, 176 Quentin St., Brooklyn 35, N. Y.

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**SWAP**—Spkr., jig saw, sound powered phones, TV tubes. TV ant. rotor TV tuner, camera. Want 16mm proj. VOM 20,000 cond. tester, test equip. Williamson type trans. J. Bazewick, 3000 N. Christiana, Chicago 18, Ill.

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**TRADE**—Want precision tube tester—612 and VOM .85 & E 200 C. Have Stromberg-Carlson TV set, short wave rcvr., car radios, F. M. Tuners, DeForest Training course, audio amplifier, misc. meters and books. John Broniszewski, 1523 W. Wabansia Ave., Chicago 22, Ill.

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**FOR SALE**—U. T. C. LS19 S. P. to P. P. grids and LS22 P. P. to P. P. each $6; and (2) VC21 variable inductors ea. $2; electro-voice model 3000, automatic TV booster, $12; Garrard R. C. 60, auto. record changer, $12. All in perf. cond. W. H. Krumbine, 2 Omaha Dr., Cranford, N. J.

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**FOR SALE**—Hickok 288X sig. gen.; 156 Indicating Traceometer; 534B tube and set tester; Knight VTVOM; Ferret test spkr.; radio parts. All in excellent cond. Very reasonable. Harry's Radio Shop, 155 W. 4th St., Winona, Minn.

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**TRADE**—Back issues of Popular Photography and Minicam magazine for back issues of Radio Electronics before 1949 and Radio and Television News before 1952. Warren W. Manke, Box 1171, Mansfield, Wash.

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**FOR SALE**—2 speed 331/3 & 78 rpm General Ind. home recording mechanism. used once for temporary testing purposes, $29.95. Trade for TV booster, 7" TV fringe zig zag all channel antenna, or any TV antenna equip. COD's accepted. Jerry Robinson, Box 466, Davenport, Wash.

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**WANTED**—Harvey Wells bandmaster deluxe model TSB 50D in good as new cond. Will pay cash. Have Tr75 TV2 to trade or sell, make offer. Amateur Criss, Childersburg, Ala.

**FOR SALE**—Packard Bell 9 tube radio phonograph comb. with switch clock. 10w. output, fairly new in excellent cond., $65; Philco tube tester, $25, excellent cond. Will trade radio phono. for TV or recorder. Paul Savelesky, c/o gen. delivery, Davenport, Wash.

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**WANTED**—A 25B8 tube, new or used. J. M. Kerrigan, 541 6th St., Braddock, Pa.

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**FOR SALE OR SWAP**—12—0 to 1 mil meters in orig. cartons; complete 10 meter mobile rig Stancore with Morrow triband converter. Al Harlock, 1854 Hillside Rd., Seven Hills Village, Cleveland, Ohio.

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**FOR SALE**—Chicago-Webster wire recorder. Mod. 78, good cond., with x'tal mike, 5-½ hr. spools of wire. C. Schroder, 7215 65th Pl., Glendale 27, N. Y.

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**FOR SALE**—Vacuum tube volt meter, Eico model 221 VTVM, like new, $20. M. J. Sadofsky, 38 Mariposa St., Mattapan 26, Mass.

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**WANTED**—Sept., Nov., and Dec. copies of Television retailing (circuit digest data). Have back issues of television retailing and RTJ magazines and many separate schematics. M. W. Vavrek, 3005 Chatham Ave., Cleveland 13, Ohio.

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**FOR SALE**—Hallicrafter 7" TV, with magnifier—$23. V. L. Madden, 412 Columbus, Tuckahoe 7, N. Y.

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**FOR SALE**—Tubetester, $25; multimeter $10; test oscillator, $25; Riders TV manuals I & II, $10 ea. All in perf. cond. John Goss, 1934 E. Westmoreland St., Phila., 34, Pa.

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**TRADE**—3—6AS7 tubes—5 5691 tubes—2 1 mill. Simpson meters—2 1500 VDC oil cond. for Acro. T. O. 300 Audio output trans. Geo. Novak, 5036 So. Kildare, Chicago 32, Ill.

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**SELL OR TRADE**—Presto K-8 disc recorder; Grunow 11B chassis with 12" permodynamic spkr. (not in working order). Gerald J. Ward, 3884 Washington Park Blvd., Newburgh Heights 5, Ohio.

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**WANTED**—RCA Voltohmyst model WV-87A or WV97A, might consider Hickok 209A; also RCA scope model 88A. J. E. Crowder, Willis Wharf, Va.

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**WANTED**—7DP4 in good cond. State price. Manes Katz, 4024 Fairfax Rd., Baltimore 16, Md.

**WANTED**—20 Hy. 250 ma. smoothing choke; 5/25 hy. 250 ma. swinging choke; 816 rectifiers. Swap 2 100TH, 2 1616 rectifiers, 4 866A rectifiers. R. Weakley, 86 Wendell St., Providence, R. I.

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**SELL OR SWAP**—Army transmitter parts: high freq. plate cond. 24v. dynamotors, crystal jack panel and switches from BC-604, coils, etc., for good electrical test equip., VOM, oscilloscope, etc. Lloyd Schmit, R. I., Brunnerdale Seminary, Canton, Ohio.

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**FOR SALE**—Rider manuals 1 to 15—1 to 5 abridged. Good cond., $9 ea., Riders TV manuals, like new 4 to 9, $21 ea. Ralph Giancola, 4367 Boswell, Overland 21, Mo.

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**WANTED**—Hickok model 156A Traceometer, also Supreme models 688 & 562 Audolyzers in steel cabinets in new cond. Paul Capito, 637 W. 21st St., Erie, Pa.

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**SELL OR TRADE**—2 No. 19 transceivers, Mark II, III, pwr. supply control boxes, operating cables, phones, antennae, spare tubes, instructions; miscellaneous radio parts. Want VTVM, VOM, scope, or what have you? P. Banks, 115 Stuart St., Sarnia, Ontario.

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**SELL OR SWAP**—Pair 832's with wafer sockets, 807's, 385-A, 6AB7's, 12A6's, like new. Harvey Schneider, 9409 Ave A, Brooklyn 36, N. Y.

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**WANTED** — Good VTVM, Oscilloscope, condenser checker, vol 2 NRI cash or trade. Have NRI sig. trace model 33 and S40A in A-1 cond. Walter E. Ninuic, Carrier No. 39, Utica P. O., Utica, N. Y.

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**FOR SALE**—Riders manuals, 1-18. 1-6 slightly used but in excellent cond. All $200 F. O. B. Suburban Radio, 33 Tilley Ave., Pompton Plains, N. J.

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**FOR SALE**—5" Simpson mirroscope model 476 complete with test leads, operators manual. Used 1 month, $100. B. S. Swink, 336 W. 11th St., New York 14, N. Y.

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**FOR SALE**—Slightly used tube tester. R. C. P. model 322A. Built into fine leather covered carrying case. Edward Talisse, 656 10th St., Brooklyn 15, N. Y.

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**FOR SALE OR SWAP**—800 paper tubular bypass condensers 4-600 VDC. Best offer. Crystal Radio Service, 391 E. 143rd. St., Bronx 54, N. Y.

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**FOR SALE**—Homemade 10w. Hi-Fi audio amplifier—separate bass and treble controls—has mike stage, $25; Bogen TV booster, like new and complete, $15. Albert Sturm, 89-47 198th St., Hollis 23, N. Y.

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**SALE**—Weston 301 a. c., d. c. basic 1MA 1000 ohms/v. meters; 17 w. w. resistors on rotary switch to use with 35 micro amps meter for Precision multitester. Snapp, 107 Comfort St., Rochester 20, N. Y.

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**FOR SALE**—Rider Manuals vol. 10 to 14 and 17, like new cond., $60 or trade for good sweep gen. or 16mm movie camera. Carl Mattson, Rte 1, Box 86, Tronwood, Mich.

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**FOR SALE**—Hickok model 605 tube and set tester with picture tube adapter, $140; like new, Heathkit model 06 scope, $38 and Heathkit sig. tracer, $18. Frank Kelczewski, 1012 Bill Rd., Schenectady, N. Y.

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**FOR SALE**—Deforest's Training, Sound Picture Radio, Television, Servicing, Home Laboratory Kit Projects 133 experiments 135 lessons year 1950; also tubes, condensers, resistors, transformers, controls, spkrs., etc. Write for list. Paul Legasse, R-1 Windham Rd., Derry, N. H.

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**WANTED** — Sig. gen. McMurdo Silver model 906. W. E. Koch, 3443 Scott, San Francisco 23, Calif.

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**WANTED**—Rider and Sams Radio and TV manuals, Sylvania Scope model 406 and Hickok equip. State cond. and price. Eugene Kurseth, 2505 Chicago Ave., Minneapolis, Minn.

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**FOR SALE**—Nearly new eqpt.: RCA Wire Recorder, 2 outdoor PA horns with 8" spkrs., 1 close-talking dynamic mike, 2 2-speed phono motors. V. L. Austin, Gibbon, Minn.

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**FOR SALE**—Crescent "45" changer—$9; Webster, "78" changer with reluctance cartridge—$12; Airline-2-station intercommunication system — $15; Turner Crystal mike—$5; Shure crystal mike with stand—$5. All in perf. cond. Phillip Lazzio, Lake Geneva, Wis.

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**FOR SALE**—Radio tubes, transformers, speakers, resistors, condensers, voltage shifter, radio manuals, radio craft, electronics, books, magazines, four-tube radio. John S. Chanin, Box 241, Benzonia, Mich.

**WANTED**—832-A tubes. Pay cash or trade .410 shotgun, box camera, ice skates, or tubes. Clinton E. Vaughan, 419 Vine St., Waterloo, Iowa.

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**WANTED**—All types aircraft radio, rcvrs., and transmitters. State cond. and price. A. J. Labloski, 336 Ellery Ave., Newark, N. J.

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**WANTED**—Operating instructions for Solar capacitor analyzer model C (CF). Serial No. F93681. Touf's Radio Service, 317 W. Pine, Crowley, La.

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**WANTED**—Good 35mm camera or 5" scope. Have CREI course, 522 trans.-rec., and 6-9 mc. command rec. for swap. Marc Molyneux, Jr., 8421 8th Ave. No. Birmingham 6, Ala.

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**FOR SALE**—Complete radio repair—equip. large asst.-of-parts—tubes, tools, and test equip.—Riders manuals. Must sell due to illness. W. B. Scott, 20 Cherry St., Oneonta, N. Y.

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**SALE OR SWAP**—Emerson comb. 14" TV radios & phono. Mahogany cabinet. Best offer or what have you? H. Blackman, 7530 Evans Ave., Chicago, Ill.

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**FOR SALE**—Superior sig. gen. model 650, RCP—VTVM model 664, both like new, 6 indoor antennas, 4000 ft. of 300-ohm lead-in. Accept any reasonable offer. Also parts, tubes, etc. Local area preferred. A. Kubre, 162 Troy Ave., Brooklyn, 13, N. Y.

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**WANTED**—Scott 33 tube Philharmonic, Scott 28 tube Phantom deluxe; Midwest 24 tube Royal in complete chassis form or with cabinet Will trade or pay cash. Woodie's Fixit Shop, 1709 E. Stella, Fort Worth 4, Tex.

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**SELL OR TRADE**—Model A. E. 1 No. A-100 sig. gen., perf and Sylvania 7" scope, needs minor repair. Both for portable typewriter or cash. Make offer. Frank W. Lauer, Box 8—Pond Rd., Lake Ronkonkoma, L. I., N. Y.

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**FOR TRADE**—Electric metering Engineering course, by Fort Wayne for a Refrigeration or Air Conditinging course by I. C. S. only. Fred Vicente, 114 E. 102 St., apt. 1, New York 29, N. Y.

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**FOR SALE**—1 to 4 original Rider manuals in perf. shape, $25 COD; also solar C B I-60 capacitor analyzer, needs repairs, $10. A. F. Hurley, 1938 N. 23 Milwaukee 5, Wis.

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**FOR SALE**—A-1 Simpson 303 VTVM, $45; 240 VOM, $17.50; Oak Ridge substitution tester, $10; Geraton 4.5w. amplifier, $17.50; Shure 707A xtal mike, $7.50; 4 tube phono amp., $5 first $100.00 gets lot postpaid. Michael Servetnick, 2014 5th Ave., Pittsburgh 19, Pa.

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**TRADE**—Unfinished pwr. supply. When finished will supply 1000v. ct., 350v. ct., 290v. ct., 5v. at 6A. and 2. 6.3v. fils., complete w/ extra 2.5v. xfmr. and 2 1616's plus meter. D. Yetman, 26 Hillside, Malden, Mass.

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**WANTED**—College graduate with Associate of Applied Science degree in Electrical Technology, and First Class FCC Radio Telephone License, seeks employment in engineering division of a Radio Station. Write, Sheldon Pivnik, 2129 E. 14th St., Brooklyn 29, N. Y.

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**FOR SALE**—Plugs new ARC-9488 ARC-9821, $.75 ea.; ARC-6577 eq. to PL-152 and PL-151 eq. to ARC-6784, $1 ea.; ARC-9126 eq. to PL-148A, $.75 ea. Edward J. Mack, 82 B'way, Bayonne, N. J.

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**FOR SALE**—A-1, $149 Webster Recorders $35; one-hour spool wire, 50c ea. J. T. Wentworh, 106 So. Dearborn St., Mobile, Ala.

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**WANTED**—Hickok model 640 or 670 oscilloscope also books on radio and TV. W. G. Gaboda, 1009 N. Washtenaw Ave. Chicago 22, Ill.

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**SELL OR TRADE**—Model 1200A Triplett VOM (two meter type—AC-DC); gasoline car heater in good shape. Want VTVM or audio equipt. Walter W. Ellett, 10111 Scenic Blvd., Cupertino, Calif.

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**TRADE OR SELL**—E. V. Booster model No. 3010. Cost $88.. Sell less tubes, $20 or what have you? Harry's Radio Service, 5232 France Ave So., Minneapolis, Minn.

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**FOR SALE**—R. M. E. model DB-22-A Preselector $55, in perf. cond.; R. M. E. NBF-4 F. M. AM adaptor for RME 45 rcvr., $15. Charles H. Bonbrake, 198 Decatur St., Corning, N. Y.

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**SWAP**—M. I. T. Laboratories 5" Synchroscope, R5-ARN7, Hickok 188X, Triplett 3212 tube tester, Silver 909 sweep gen., Crosley portable, BC611, Portable diathermy, BC603, transformers, condensers, tubes, dynamotors. Want—Tape or wire recorder, commercial Rcvr. or? E. L. Brandmeier, 1513½ So. Albert St., Allentown, Pa.

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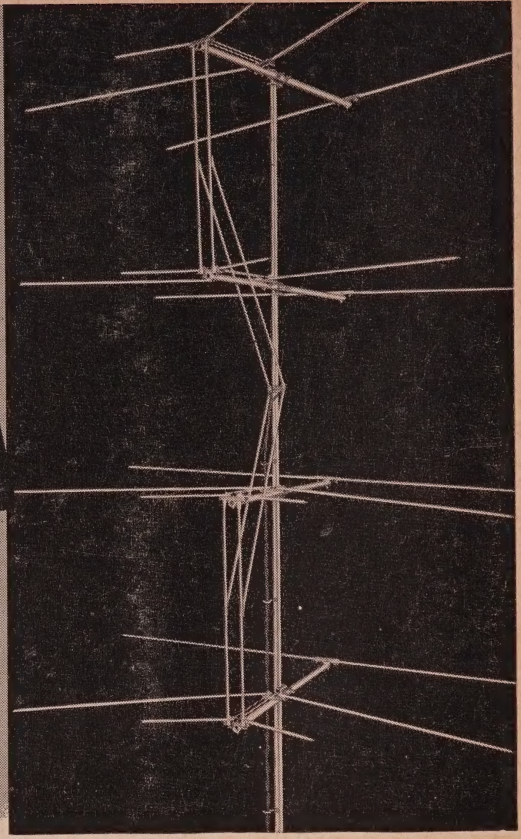

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